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NEW PUBLICATIONS

July-September 1986

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

240 West Prospect Street **Fort Collins, Colorado 80526**

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Order Number

Order Number ORIGINAL

RESEARCH PAPERS

29 Crouch, Glenn L. 1986. Effects of thinning pole-sized lodgepole pine on understory vegetation and large herbivore activity in central Colorado. USDA Forest Service Research Paper RM-268, 10 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

Thinning treatments to control growing stock levels (GSL) in a stand of 65-year-old lodgepole pine enhanced understory plant production, cover, and forage quality 5 years after treatment. Plant use and large herbivore activity also increased in the more heavily thinned blocks.

30 Alexander, Robert R., Carleton B. Edminster, and Ross K. Watkins. 1986. Estimating potential Engelmann spruce seed production on the Fraser Experimental Forest, Colorado. USDA Forest Service Research Paper RM-269, 7 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

Two good, three heavy, and two bumper spruce seed crops were produced during a 15-year period. There was considerable variability in seed crops, however. Not all locations produced good to bumper seed crops when overall yearly ratings averaged good or better; conversely, some locations produced bumper seed crops in 3 or more years. Mathematical relationships, that should be useful in estimating potential sound seed production, were estimated between periodic annual 15-year sound seed production and (1) periodic annual 15-year total seed production and (2) selected stand parameters of dominant and codominant spruces.

31 Hopkins, Rick B.*, J. Frank Cassel*, and Ardell J. Bjugstad. 1986. Relationships between breeding birds and vegetation in four woodland types of the Little Missouri National Grasslands. USDA Forest Service Research Paper RM-270, 12 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

Bird species richness was greater in the cottonwood type than in the juniper, pine, and ash woodland types. Total breeding bird densities were greatest in the green ash woodland type. The densities of 25 bird species were significantly different among the four woodland types. The densities of birds in five foraging guilds and four nesting guilds were significantly different among the four woodland types. The influence of vegetation on bird community structure is discussed and suggestions are made for preserving and reestablishing woodlands threatened by the strip-mining of lignite coal.

32 Alexander, Robert R., George R. Hoffman*, and John M. Wirsing*. 1986. Forest vegetation of the Medicine Bow National Forest in southeastern Wyoming: A habitat type classification. USDA Forest Service Research Paper RM-271, 39 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

A vegetation classification based on concepts and methods developed by Daubenmire and refined by others was used to identify 16 forest habitat types on the Medicine Bow National Forest. These included two habitat types in in the *Pinus flexilis* series; three each in the *Pinus ponderosa, Populus tremuloides,* and *Abies lasiocarpa* series; and five in the *Pinus contorta* series. A key to identify the habitat types and the management implications associated with each are provided.

*Federal, state, or private cooperator.

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33 **Francis, Richard E. 1986. Phyto-edaphic communities of the upper Rio Puerco Watershed, New Mexico. USDA Forest Service Research Paper RM-272, 73 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.**

The upper Rio Puerco Watershed in northern New Mexico was classified into 45 ecological phtyo-edaphic communities using cluster analysis based on species importance values. The community descriptions consist of vegetation and soil surface characteristics; landform; soil series, association, or complex; ecological stage; and potential natural vegetation. The communities represented 11 vegetation series consisting of 2 treeland, 5 shrubland, and 4 grassland formations. Three soil orders, 27 soil series, 9 associations, and 3 soil complexes were identified. The combination of landform, vegetation, and soil were considered phyto-edaphic communities. A dichotomous key was developed for field identification.

GENERAL TECHNICAL REPORTS

34 **Rosenthal, Donald H., Dennis M. Donnelly, Marie B. Schiffhauer, and Glen E. Brink. 1986. User's guide to RMTCM: Software for travel cost analysis. USDA Forest Service General Technical Report RM-132, 32 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.**

RMTCM is an interactive, menu-driven program for performing travel cost analysis. The program consists of four main modules: (1) data input, (2) data modification, (3) regression analysis, and (4) report writing. The report graphs the "second-stage" demand curve and estimates consumer surplus. The program is written in FORTRAN-V, and a version is available for use on an IBM personal computer or compatible machine.

35 **Joyce, Linda, David E. Chalk*, and Andy Vigil*. 1986. Description of range forage data base. USDA Forest Service General Technical Report RM-133, 17 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.**

This paper documents the development and structure of the Range Forage data base, a subset of information from all Soil Conservation Service Range Site Descriptions for 20 states: Arkansas, Arizona, California, Colorado, Florida, Idaho, Louisiana, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wyoming. Information in the data set includes range site name, location identifiers, total annual production, soils information, and initial stocking level rates. Data are accessible via tape from the USDA Fort Collins Computer Center. These data can be used to analyze range site productivity within a state, between states, or across regions.

36 **Alexander, Robert R. 1986. Engelmann spruce seed production and dispersal, and seedling establishment in the central Rocky Mountains. USDA Forest Service General Technical Report RM-134, 9 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.**

Engelmann spruce seed production and dispersal, and seedling establishment in the central Rocky Mountains indicate that in the *Abies lasiocarpa/Vaccinium scoparium* habitat type, shaded, mechanically scarified, mineral soil seedbeds on north aspects can be adequately restocked naturally within a 5-year period in clearcut openings 300 to 450 feet wide. With shade or scarification alone, size of opening that will restock is reduced to 200 to 350 feet. The effective seeding distance is so limited on unshaded natural seedbeds on north aspects and on south aspects regardless of the seedbed conditions that the expectation of natural restocking in a reasonable period of time with clearcutting, is not a realistic option.

RESEARCH NOTES

37 **Crouch, Glenn L. 1986. Aspen regeneration in 6- to 10-year-old clearcuts in southwestern Colorado. USDA Forest Service Research Note RM-467, 4 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.**

Aspen regeneration in 6- to 10-year-old clearcut blocks was substantially less than these values from the same blocks at ages 1 to 5 years. Damage from disease and other environmental factors has reduced the numbers and distribution of sprouts to levels that preclude successful restocking of several of the blocks studied.

38 **Markstrom, Donald C., and John C. Windsor*. 1986. Feasibility of collecting firewood blocks with a small skyline. USDA Forest Service Research Note RM-468, 5 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.**

Firewood collection from the Nation's forests has been increasing rapidly. Additional areas are needed for firewood collections in the future. Areas above and adjacent to roads but having slopes too steep for collectors to either hand-carry or drag wood have potential if an easier method of moving wood were

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available. A single-span skyline made from No. 9 wire and other materials from a farm and ranch store has potential for moving firewood down slopes by gravity. A mathematical model was used initially to calculate maximum spans that would not exceed tension and deflection limits. Subsequent field testing showed that the predicted spans were quite conservative.

RESOURCE BULLETIN

39 Donnelly, Dennis M., and Louis J. Nelson*. 1986. Net economic value of deer hunting in Idaho. USDA Forest Service Resource Bulletin RM-13, 27 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

Average net willingness to pay in addition to actual expenditure for deer hunting in Idaho was estimated with the Travel Cost Method at $50.23 per trip and with the revised 1983 Contingent Value Method at $40.09

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40 Davis, Edwin A., and Leonard F. DeBano. 1986. Nitrate increases in soil water following conversion of chaparral to grass. Biogeochemistry 2:53-65.

An Arizona watershed converted from chaparral to grass, released high concentrations of nitrate to stream water. The nitrate originated from the rooting zone of the decomposing shrubs. High nitrate concentrations (44-373 ppm) were found in soil solutions from 1.5-, 3.0-, and 4.6-m depths on the converted watershed as compared with low nitrate concentrations (0.2-6.2 ppm) found in an adjacent undisturbed area. Soil solution nitrate concentrations at the 0.3-m depth were generally low, especially in the untreated area. High nitrate concentrations were balanced mainly by relative decreases in bicarbonate anions in the soil solutions and in the stream water. Multiple stepwise regression analyses showed improvement in the regression of bicarbonate on nitrate when chloride and sulfate anions were entered as variables.

41 Kaufmann, Merrill R., and Edwin L. Fiscus*. 1985. Water transport through plants--Internal integration of edaphic and atmospheric effects. Acta Horticulturae 171:83-93.

Water transport through plants is influenced by plant structure along the transport pathway, physiological processes, and environmental conditions. Water movement follows standard transport principles, but the gradients and resistances within pathway segments are not independent of those in the rest of the transport system. In horticultural trees, water transport apparently is not strongly influenced by solute absorption by roots, partitioning of water for growth, or diurnal changes in stored water. Furthermore, the size of the absorbing root system conducting tissue in the xylem, and leaf transpiring surface appear to remain in balance through physiological feedback mechanisms.

42 Modde, Timothy*, Henry G. Drewes*, and Mark A. Rumble. 1986. Effects of watershed alteration on the brook trout population of a small Black Hills stream. Great Basin Naturalist 46(1):39-45.

The impacts of adjacent landscaping activity and livestock presence on the brook trout population of a small Black Hills stream were evaluated. Moderate changes in temperature, turbidity, and fecal coliform numbers did not influence brook trout densities. Stream morphometry, particularly factors affecting stream cover, appeared to have the greatest impact on numbers of trout. Brook trout were poor indicators of moderate changes in water quality, but they were adequate indicators of the physical perturbations within the stream.

43 Sturges, David L. 1986. Precipitation measured by dual gages, Wyoming-shielded gages, and in a forest opening. p. 387-396. In: Proceedings of the symposium: Cold Regions Hydrology, Douglas L. Kane, editor. American Water Resources Association, Bethesda, Md.

Wyoming-shielded gages undermeasured precipitation received as snow, but not as rain. Dual gages provided precipitation estimates similar to measurements in a forest opening in 8 of 12 months. Relationships were developed to predict precipitation undermeasurement by a Wyoming-shielded gage based on storm wind speed, or day number.

44 Tabler, Ronald D., and David L. Sturges. 1986. Watershed test of a snow fence to increase streamflow: Preliminary results. p. 53-61. In: Proceedings of the symposium: Cold Regions Hydrology. Douglas L. Kane, editor. American Water Resources Association, Bethesda, Md.

Although snow fences have long been proposed as a method to increase water yield, the feasibility of this practice has not been established. This paper reports hydrologic changes the first 2 years after construction of an 800-m long snow fence, 3.78-m tall, on a 307-ha paired watershed having 10 years of pretreatment data. Snow accumulation increased about 58%, and streamflow averaged 237% of that predicted by the pretreatment calibration with the control watershed. Flow duration on the ephemeral stream increased about 18 days.

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AVAILABLE FROM OTHER SOURCES

The following publications, not available from the Rocky Mountain Station, are available directly from the publisher, or at most university and some public libraries.

Brown, Thomas C., and Terry C. Daniel*. 1986. Predicting scenic beauty of timber stands. Forest Science 32(2):471-487.

The psychophysical approach to developing scenic beauty models is extended to the timber stand level. Ponderosa pine timber stands are shown to be quite homogeneous in terms of variables important in the prediction of scenic beauty. Candidate timber stand scenic beauty models are presented, along with the results of cross-validation experiments. The models agree with earlier studies that focused on one-acre plots, suggesting that scenic beauty increases with increases in herbage and large pine and with decreases in downed wood, and tree grouping. Finally, judgments of the scenic beauty of individual color slides taken within timber stands provide valid estimates of overall stand scenic beauty of conventionally delineated timber stands based on standard forest inventory information.

Crouch, Glenn L. 1986. Pocket gopher damage to conifers in western forests: A historical and current perspective on the problem and its control. p. 196-198. In: Proceedings of the 12th Vertebrate Pest Conference. [San Diego, Calif., March 4-6, 1986]. 395 p. T. P. Salmon, editor. University of California, Davis.

Pocket gophers damage or destroy regeneration on hundreds of thousands of acres of forestland in the western United States each year. Despite years of research, poisoning the offending animals--a technique developed around the turn of the century on agricultural land--is still the most prevalent practice for controlling damage on western forests.

Heede, Burchard H. 1986. Designing for dynamic equilibrium in streams. Water Resources Bulletin 22(3):351-357.

Streams are dynamic systems, so steady state does not exist for any appreciable period of time. Streams in dynamic equilibrium respond quickly to change, regaining a new equilibrium. Examples are presented of treatments causing new critical situations and measures to correct them.

Hibbert, A. R., and E. A. Davis. 1986. Streamflow response to converting Arizona chaparral in a mosaic pattern. p. 123-131. In: Hydrology and Water Resources in Arizona and the Southwest. [Glendale Community College, Ariz., April 19, 1986] Volume 16. American Water Resources Association, Tucson, Ariz.

Converting 55% of an Arizona chaparral watershed to grass in a mosaic pattern, giving major consideration to wildlife habitat values, water quality, and landscape esthetics, produced an average of 68 mm of extra streamflow per year from the watershed during a 4-year evaluation period. When the increased streamflow was prorated to the area actually treated, the increase amounted to 124 mm. Increases in streamflow were largest in winter, and streamflow was extended considerably longer into the dry periods than before treatment.

Loudenslager, Eric J.*, John N. Rinne, G. A. E. Gall*, and Robert E. David*. 1986. Biochemical genetic studies of native Arizona and New Mexico trout. The Southwestern Naturalist 31(2):221-234.

Populations of Gila trout, *Salmo gilae*, and Apache trout, *S. apache*, from New Mexico and Arizona, respectively, as well as a trout, *Salmo* sp., population from the Rio Mayo, Mexico, were analyzed for protein polymorphisms at 36 presumptive genetic loci using starch gel electrophoresis. *Salmo gilae* and *S. apache* were more similar to each other than either was to *S. gairdneri, S. clarki,* or Rio Mayo *Salmo*.

Mitchell, John E., and Linda A. Joyce. 1986. Use of a generalized linear model to evaluate range forage production estimates. Environmental Management 10(3):403-411.

Interdisciplinary teams have been used in federal land planning and in the private sector to reach consensus on the environmental impact of management. When a large data base is constructed, verifiability of the accuracy of the coded estimates and the underlying assumptions becomes a problem. A mechanism is provided by the use of a linear statistical model to evaluate production coefficients in terms of errors in coding and underlying assumptions. The technique can be used to evaluate other intuitive models depicting natural resource production in relation to prescribed variables, such as site factors or secondary succession.

Raphael, Martin G., Cathy A. Taylor*, and Reginold H. Barrett*. 1986. Smoked aluminum track stations record flying squirrel occurrence. USDA Forest Service Research Note PSW-384, 3 p. Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

Smoked aluminum track stations are a useful technique for studying patterns of abundance and distribution of northern flying squirrels. They are easily transported to remote field sites, allow permanent preservation of tracks, and yield frequency-of-occurrence information. A study in Douglas-fir forests of northwestern California illustrates the use of the track stations, methods of data analysis, and habitat association of the northern flying squirrel.

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Rinne, John N. 1986. Endangered and nongame fish programs in the West. Their role in the conservation of native fishes. p. 456-469. In: Western proceedings:64th annual conference of the Western Association of Fish and Wildlife Agencies. [Victoria, British Columbia, July 16-19, 1984]. California Department of Fish and Game, Sacramento.

Nine of 13 western states have nongame/rate-endangered fishery programs. The importance of state nongame programs is illustrated by the fact that 172 taxa of fish are listed under state programs, compared to only 31 that are federally listed.

Rosenthal, Donald H., and Richard G. Walsh*. 1986. Hiking values and the recreation opportunity spectrum. Forest Science 32(2):405-414.

The contingent valuation technique is used to estimate the net economic value of hiking and backpacking in a national forest in the Front Range of the Colorado Rockies. The study is based on on-site interviews of 202 hikers, conducted during the summer of 1981. The relationship between dollar value and recreation opportunity spectrum (ROS) class reverses when the unit of measure is switched from trips to recreation visitor days. Trips to the more primitive ROS classes have high consumer surplus, but last a long time, thereby lowering the consumer surplus per recreation visitor day.

Schmidt, R. A. 1986. Snow surface strength and the efficiency of relocation by wind. p. 355-358. In: Proceedings of the symposium. Cold Regions Hydrology. Douglas L. Kane, editor. American Water Resources Association, Bethesda, Md.

An automated system developed by Martinelli and Ozment samples forces required to fracture grains from a snow surface. The device has sufficient sensitivity to measure differences in surface erodibility under saltating drift. Such measurements help explain differences in the efficiency with which wind transports snow.

Scholl, David G., and Earl F. Aldon. 1986. Grass establishment on uranium exploration sites in New Mexico. p. 95-97. In: Proceedings--New horizons for mined land reclamation. [Jackson, Miss., March 17-20, 1986]. American Society for Surface Mining and Reclamation, Princeton, W. Va.

This study was conducted in the Grants uranium district on a site disturbed by linear prospecting. Eight prospects within a 2-km^2 area were regraded and grasses established using four treatments: combinations of straw incorporation, furrowing, straw mulching, and drill seeding. Treatments were evaluated after 5 years. Galleta and blue grama grasses responded well to the furrowing and straw incorporation treatments. Total cover and production were also improved by straw incorporation. Because galleta and blue grama are valuable for both forage and watershed protection, their improved establishment through incorporation of straw and furrowing is recommended.

Schreuder, H. T., and G. G. Wood*. 1986. The choice between design-dependent and model-dependent sampling. Canadian Journal of Forest Research 16:260-265.

Design-dependent and model-dependent sampling strategies are discussed. Model-dependent strategies can be very efficient in highly specialized sampling situations where an underlying model can reasonably be assumed, such as in sampling for timber sales, but can also be very unreliable if the wrong model is assumed. This is illustrated by the application of stratified sampling with probability proportional to size (a design-dependent sampling scheme) and stratified sampling from the cumulated values of an independent variable x (a model-dependent, purposive sampling scheme) to selected data sets with somewhat diverse characteristics.

Shepperd, Wayne D., and Sue E. McElderry. 1986. Ten-year results of a ponderosa pine progeny test in the Black Hills. Western Journal of Applied Forestry 1(3):79-83.

Ten-year survival and growth of seedlings from 77 parent trees from throughout the Black Hills were compared, using a cluster-analysis technique. Five clusters are identified that account for most of the variability in survival and growth of the open-pollinated families. One cluster, containing 6 families, exhibited exceptional survival and growth. Another, containing 12 families, exhibited poor survival and growth. The performance of families in these two groups appears to be related to location and elevation of parent trees.

Sieg, Carolyn Hull, Daniel W. Uresk, and Richard M. Hansen*. 1986. Seasonal diets of deer mice on bentonite mine spoils and sagebrush grasslands in southeastern Montana. Northwest Science 60(2):81-89.

Deer mice captured on bentonite mine spoils and sagebrush grasslands consumed mainly arthropods and seeds. Arthropod consumption was negatively correlated with availability and positively correlated with precipitation, indicating that deer mice apparently do not seek arthropods as a source of moisture. However, forb consumption was positively correlated with availability and negatively correlated with precipitation, indicating that deer mice eat forbs when available, but in increased amounts during periods of drought. Deer mice selected for specific types of arthropods and plants, but their selectivity may be partly an expression of the habitat.

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Sturges, David L., and David L. Nelson*. 1986. Snow depth and incidence of a snowmold disease on mountain big sagebrush. p. 215-221. In: Proceedings--Symposium on the biology of Artemisia and Chryothamnus. [Provo, Utah, July 9-13, 1984]. USDA Forest Service General Technical Report INT-200, 398 p. Intermountain Forest and Range Experiment Station, Ogden, Utah.

A snowmold disease of mountain big sagebrush induced by an unidentified fungus, was discovered in Wyoming in 1973. Snowmold was present on 2% of sagebrush plants where maximum snow accumulation was less than 16 inches (40 cm), and 93% of plants where maximum accumulation exceeded 47 inches (119 cm). The disease reduces the canopy area or kills mountain big sagebrush plants in areas of deeper snow accumulation.

Szaro, Robert C. 1986. Guild management: An evaluation of avian guilds as a predictive tool. Environmental Management 10(5):681-688.

The use and applicability of the guild concept to management is evaluated and questioned. Ecological problems are never as simple as implied in using one or two guild axes. A close examination of bird communities in a ponderosa pine forest reveals little relationship between guilds or guild blocks in the responses exhibited by individual bird species or bird species groups. The whole concept of guild management needs much more research and development before it can be recommended as a management tool.

Uresk, Daniel W., Rudy M. King, Anthony D. Apa*, and Raymond L. Linder*. 1986. Efficacy of zinc phosphide and strychnine for black-tailed prairie dog control. Journal of Range Management 39(4):298-299.

Three rodenticide treatments, zinc phosphide (prebaited) and strychinine (both with and without prebait), were evaluated immediately following treatment for efficacy of controlling black-tailed prairie dogs in western South Dakota. Active prairie dog burrows were reduced 95% with zinc phosphide, 83% with strychnine (prebaited), and 45% with strychnine without prebait. Zinc phosphide was the most effective in reducing active burrows of prairie dogs.

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